TT 67-51230

From: Problemy Severa, No. 8 : 280 – 289. 1964.

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(Olen'i pastbishcha Verkhoyan'ya i vozmozhnosti ratsionalizatsii ikh ispol'zovaniya)

Translated from Russian
IPST Cat. No. 1861

Available from
U. S. DEPARTMENT OF COMMERCE
Clearinghouse for Federal Scientific and Technical Information
Springfield, Va. 22151

Published Pursuant to an Agreement with
The U. S. Department of the Interior and
The National Science Foundation, Washington, D. C., by the
Israel Program for Scientific Translations
Jerusalem 1967

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POSSIBILITIES FOR RATIONALIZED USE OF THE VERKHOYANSK DEER PASTURES

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V. B. KUVAEV

Northern deer breeding is the only land trade (except hunting) which is intimately connected with utilization of natural reserves. The immense reindeer moss reserves of the Subarctic zone are practically unutilized except by reindeer. Although reindeer moss (the main ingredient of reindeer diet) is found throughout the area, the feed components vary widely during the year in different regions of the Far North (Vashkevich, 1932; Ustinov, 1956; Kuvaev and Samarin, 1961), as do the pastures. Nevertheless, surveys of deer pastures still use standardized criteria, disregarding specific conditions of individual deer-breeding regions, apparently from lack of data.

We have investigated the botanical composition of the feed and the feeding habits of local reindeer in the Tompo District of the Yakutsk ASSR (Verkhoyansk Range) (Kuvaev and Samarin, 1961). I will now describe the Verkhoyansk area reindeer pastures and indicate some ways in which they could be more fully exploited.

We have already presented a brief physical-geographical and botanical description of the Tompo District (Kuvaev and Samarin, 1961). Let us recall that it is characterized by its subdivision into two clearly defined and quite different geomorphological regions: the southern narrow-valley or ridged (Aldan) region, and the northern wide-valley or flat-topped (Yano-Indigirka) region. Within the limits of each region, all pastures are divided into slope or valley pastures; the latter are of major importance.

I have subdivided the local pastures into seven basic groups according to grazing season.

I. Calving pastures

The requirements for calving pastures are very exacting. The most important is a combination of very early herbage (with sheathed cotton grass *Eriophorum vaginatum* L. predominating), with overwintered feeds other than reindeer moss and abundant reserves of *Cladonia alpestris* (L.) Rabh. At calving time, the herds require pastures where these feeds are found in large quantities because they remain there for about two months. The fawns are susceptible to cold and the herd must seek warm wooded

spots protected from wind, where the snow melts early. Since the fawns are unable to make long journeys, the herd must choose calving pastures in the vicinity of its late-spring and early-summer pastures. In the former Kommunar kolkhoz, the herds had to reach calving pastures by extremely long treks from the Aldan River basin northward to the Yana River basin through the passes.

In the plant cover of the calving pastures we noted six basic associations.

1. Tussocky pastures with sheathed cotton grass (Eriophorum vaginatum) predominating on marshy flat bottomlands. The reserve of sheathed cotton grass (cop.$_3$, coverage 45%) is estimated at 1000–1300 kg/ha. An admixture of cereals (the reedgrass Calamagrostis lapponica (Wahlenb.) Hartm., the arctic bent grass Arctagrostis arundinacea (Trin.) Beal., and others) gives about 100 kg/ha. There are substantial reserves of lichens in natural associations, but in time they are burnt. There is a considerable admixture of birch (Betula exilis Sukacz.) (about 100 kg/ha) and various willows.

2. Cotton grass–dwarf birch (creeping shrub) areas. This is similar to the preceding association except that in this association Betula exilis predominates (in summer about 800 kg/ha); it is not utilized to any extent during calving time.

3. Lichen–dwarf birch valleys. The original reserves of Cetraria cucullata (Bell.) Ach. and of Cladonia are very large, but as grazing proceeds they are completely destroyed.

4. Sparse larch woodlands with a thick carpet of Cladonia alpestris (reserves up to 7000 kg/ha) are the basic source of reindeer moss during the calving season.

5. Cereal–mixed grass* and willow stands with the willows Salix phylicifolia L. and S. pentandra L. The reserve of willow foliage reaches 1800 kg/ha and more in summer; in spring, buds are the principal feed. The green portion of cereals (Poa sp. and others) is approximately 500–600 kg/ha. There are usually feeds other than reindeer moss on glades which have survived the winter: variegated horsetail Equisetum variegatum Schleich., milk vetch Astragalus umbellatus Bunge, and others.

6. Thickets of Chosenia arbutifolia (Pall.) Skv. and Chosenia–poplar groves. The chief feed consists of tree leaves from the preceding year; it is difficult to estimate the quantities.

The principal shortcomings of calving pastures are: reindeer moss valley pastures are totally destroyed by continuous year-long grazing; those on sparse woodland and barren slopes are often destroyed by careless burning of old cotton grass pastures, designed to increase the latter's growth; some pastures are too remote from wintering places and the gravid does become exhausted by lengthy treks.

II. Spring pastures

When the fawns become sufficiently strong and the herds move from calving pastures to spring pastures, the weather is already relatively warm. The main requirement for spring pastures, besides proximity to the

* [Russian term "raznotrav'e" ("mixed grass") = mixed herbs other than Graminaceae, Cyperaceae and Leguminosae.]

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calving pastures, is sufficient reserves of early herbage. This requirement is easily met because most vascular plants (especially grassy plants) begin their growth at this time of the year. Spring pastures are rather widely distributed. The most common are cereal meadows and willow groves on and above floodplains.

1. Meadow grass—bromegrass meadows are particularly widely distributed; they contain the bromegrass Bromus sibiricus Drob., and the meadow grasses Poa sibirica Roshev. and P. pratensis L. There is usually an admixture of other cereals: the perennial oat Avenastrum dahuricum (Kom.) Roshev. var. kamtschaticum Kom., the trisetum Trisetum subalpestre Neum., the bent grass Agrostis trinii Turcz., etc. The total yield is 1200—1400 kg/ha.

2. Perennial oat meadows with Avenastrum dahuricum occupy smaller areas, but are frequented more by deer. In addition to perennial oat, bromegrass, and Siberian meadow grass there is an abundant admixture of wild rye Elymus villosissimus Scribn. s. l., fescue Festuca lenensis Drob., various mixed grasses and low shrubs (the wormwood Artemisia arctica Less. s. l., the willow Salix fumosa Turcz., and others). The yield reaches 1600 kg/ha.

3. Meadows with Elymus villosissimus (cop.$_2$, projective coverage 20%) have a considerable admixture of other cereals (the fescue Festuca rubra L. var. glabra Trautv., the reedgrass Calamagrostis lapponica, and others), of many valuable fodder species of mixed grass (Nardosmia populifolia (Smith) Schischk. (cop.$_1$, coverage 3%), N. glacialis Ledeb. (cop.$_1$, 5%), Valeriana capitata Pall. (cop.$_1$, 2%), Oxytropis adamsiana (Trautv.) Jurtz. (up to cop.$_1$, and others)) and of small sedges (Carex bigelowii Torr. s. l., C. melanocarpa Cham. et Trautv., and others). Their total yield is about 1300 kg/ha.

4-5. Meadow grass and bent grass steppe pastures and poor meadow grass pastures are used in local deer raising as second-grade lands.

The importance of meadows to deer breeding in Kharaulakh was noted by V. A. Sheludyakova (1940), but there they are more utilized in July-August.

6. Willow groves in valleys of the Yana Basin have a cover containing most of the cereals mentioned in the description of meadows; there is much mixed grass. The yield is 1500 kg/ha. The available foliage of woody willows (Salix xerophila Flod. and others) amounts to 200—300 kg/ha. It is advisable to use the willow groves before the meadows because of the better protection from wind.

The above associations are utilized in combination with reindeer moss pastures on slopes. If these are too remote or absent, it is a serious shortcoming for spring pastures. When other pastures are exploited year after year, the grassy vegetation becomes firmly established, though an interval in grazing once in several years would lead to still more succulent growth.

III. Early-summer pastures

Assuming that the transition from grazing upon grass to browsing upon shrub foliage distinguishes between spring and summer grazing, we may consider the summer season as adequately provided with feed, since the thickets of birches Betula exilis and B. middendorffi Trautv. et Mey. and of shrubby willows at the borders of woody vegetation in the given area are very great (especially in the northern, wide-valleyed part). The following associations are the most characteristic.

1. Floodplain and supra-floodplain willow groves with the willow Salix krylovii E. Wolf, hypnum—cereal, big-cereal, or low-shrubby willows. The reserve of feeds in one of these willow groves was: Salix krylovii — 22,500 kg/ha, S. pulchra Cham. — 10, Calamagrostis lapponica — 525, the snakeweed Polygonum alpinum All. — 30, other green feeds — 75; total green feeds — 28,900 kg/ha; lichens — 1600 kg/ha.

2. Riverside thickets of the willow Salix speciosa Hook. Under its canopy the grasses are very variegated but sparse (the reedgrass Calamagrostis langsdorfi (Link) Trin., Oxytropis adamsiana, and others). The reserve of readily eaten foliage of S. speciosa to a height of 1—2.5 m and at a coverage of 70% amounts to 1600 kg/ha. The importance of this association lies in the combination of good feed, coolness and shelter from insects.

3. Creeping shrub (dwarf birch) tundras. The buds and the foliage of the birches Betula exilis and B. middendorffi are not readily eaten by deer, but since they occupy large areas and are abundant, their importance as pastures is great. The reserve of feeds in dwarf-birch stands with lichen and small cereals is: Betula exilis — 600 kg/ha, Calamagrostis lapponica — 245, Carex bigelowii — 9, etc., a total of 865 kg/ha; lichens — 2400 kg/ha.

4. Valley complex of moist tundras (low shrub—cotton grass boggy tundra + bogs with the sedge Carex stans Drej. + sphagnum—cotton grass—dwarf birch + willow stands with Salix krylovii); on the adjacent slopes, horsetail and Iceland-moss tundras are found. They are used very little.

5. Elevated valleys with cotton grass tussocks adjoin the pastures used in the second half of summer. The reserves of Eriophorum vaginatum amount to 700 kg/ha, those of small willows (Salix fumosa, S. psylostachya Turcz.) to 100—150 kg/ha.

6. Since reindeer moss constitutes 20—25% of the deer's diet in summer, larch woodlands, treeless areas and stone pine stands on slopes with lichens are an indispensable component in the complex of summer pastures. There is no rotational grazing on these pastures and as a result the cladonia lichens are almost completely replaced by Iceland moss, horsetail lichen and Stereocaulon species; the grazing percentage reaches 60%.

The main shortcoming of the exploited early-summer pastures is that the reindeer moss areas are completely destroyed, so that summer grazing in the Verkhoyansk area cannot be considered the best. The regeneration period is about ten years.

IV. Summer pastures

The onset of hot days and the appearance of bloodsucking flies compels the herds to pass to high mountain zones devoid of trees and shrubs, which are well developed in the north, in the wide-valleyed region. The basic forms especially characteristic and suitable for grazing pastures among the so-called "chistais" (grassy tundras upon peaty sod—mountain tundra soils irrigated by flowing water) were briefly described earlier (Kuvaev, 1960). Below I present a geobotanical description of one such association.

Description No. 407, 13 August 1954. Humid willow—mixed grass tundra on "chistai."

Right bank of Khunkhada River, a wide valley in the upper reaches of left tributary of Sanar River (Tompo basin, lower Aldan). Slope—SSW, 5° altitude 1425 m. Planar. Microrelief thinly hilly-hillocky. No exposed rocks. Fresh grass-green color. The soil is very moist. Water appears sometimes when the soil is stepped on; flow somewhat hampered.

Soil excavation—23 cm

A_0 0—1.5 cm. Litter of undecomposed low-shrub foliage, lichen and moss remains.

A_1 1.5—7 (10) cm. Dark brown, moist, slightly lumpy, silty loam, with a large number of small rocks; interwoven by rhizomes and woody roots into a rather tough sod.

B 7(10)—23 cm. Gray-brown to brown, humid, very slightly lumpy, stony-loamy; there are relatively few roots.

C below 23 cm. Similar to B, but rocks and cobble prevail.

No effervescence over the profile of excavation.

Skeletal-loamy, mountain tundra, ligneous-sod soil.

Vegetation

Trees and shrubs are almost entirely absent. Low shrubby—grassy cover with total coverage of 70%, height 10—12 cm: cop.$_2$—Carex bigelowii Torr. s.l. (15%), Dryas punctata Juz. (20%); cop.$_1$—Astragalus umbellatus (10%), Salix psylostachya (5%), S. fumosa (10%); cop.$_1$—sp.—Eriophorum vaginatum (3%), Betula exilis (1%), Vaccinium vitis-idaea; sp.—Hedysarum obscurum L. s.l., Oxytropis adamsiana, Polygonum viviparum L., Poa arctica R. Br., Luzula nivalis (Laest.) Beurl., Claytonia acutifolia Pall., Pedicularis oederi Vahl, P. verticillata L., P. lapponica L., Valeriana capitata, Salix reticulata L.; sp.—sol.— Stellaria ciliatosepala Trautv., Arctagrostis latifolia (R. Br.) Griseb.; sol.—Hierochloë alpina (Liljebl.) Roem. et Schult., Festuca sp., Lagotis minor (Willd.) Standl., Minuartia macrocarpa (Pursh) Ostenf., Saxifraga redowskii Adams, S. punctata L., Luzula confusa

Lindb. Outside the area: Eriophorum scheuchzeri Hoppe—sp. gr., Artemisia arctica — sol.

The above-soil carpet: mosses with a coverage of 35%, 6 cm in height: cop.$_2$ Aulacomnium turgidum (Wahlb.) Schwgr. (20%); cop.$_1$—gr. Dicranum elongatum Schleich. (5%); sp.—Hylocomium proliferum (L.) Lindb., Rhytidium rugosum (Hedw.) Lindb., Webera sp.; sol.—Dicranum bonjeanii De Not., Ceratodon purpureus (Hedw.) Brid., Pogonatum urnigerum (Hedw.) P.B.

Lichen with a coverage of 3%, 3 cm in height, almost completely uprooted; very little eaten; cop.$_1$—sp.—Cetraria cucullata (Bell.) Ach.; sp.—Cetraria islandica (L.) Ach., C. richardsonii Hook, Cladonia sylvatica (L.) Hoffm., C. rangiferina (L.) Web., C. Pyxidata (L.) Fr., Dactylina arctica (Hook) Nyl.; sol.—Stereocaulon paschale (L.) Fr., Peltigera aphthosa (L.) Willd., P. rufescens (Weiss.) Humb., Cladonia alpestris (L.) Rabh.

Economic characteristics

Summer pasture of the first herd of Pobeda kolkhoz; total area more than 250 ha; insufficiently exploited, chiefly for herd transfer from Sulid'un River to Sanar River; reserves of green feed—1000 kg/ha (for willow—cotton grass plots on the same "chistai"—1500 kg/ha), almost untouched by grazing; lichens have been destroyed in the valley (they are present on adjacent slopes). Water is within easy reach everywhere. Aeration good; very few mosquitos. Probability of getting foot and mouth disease is small. Suitable for pasture during the hot summer days.

The "chistais" are confined to the most elevated parts of Verkhoyansk system; they are especially well developed in high mountain glacier valleys of the divide and the Yana basin. These are ideal summer pastures, but their areas are restricted. Since the herds are large, such relatively small "chistais" can generally not be exploited economically. The grounds which were established principally as a result of deer breeding nowadays limit its development, since the number of large "chistais" is insufficient to maintain the existing large herds during the hot season. When the days become cooler, the herds descend from the barren summits to the early-summer pastures.

V. Early-fall pastures

Frequent early-fall frosts (end of August) cause the foliage in "chistais" to become coarse, decay and fall, and the bloodsucking flies disappear.

The herds descend into the zone beneath the bare summits (see section III): here the deer feed on foliage and buds of willows, Chosenia arbutifolia, some dwarf birch, the horsetail Equisetum variegatum, Umbelliferae, and others. Now, as distinct from early-summer feeding, the consumption of reindeer moss increases greatly; on fall pastures, there needs to be as much reindeer moss as other feeds.

In the plant cover of the Tompo District there are no buckbean, cinquefoil, or large sedges with large rhizomes; the rhizomes of Carex stans, the largest sedge present, are rather small. Bog associations are situated mainly in the wide-valleyed region, remote from wintering places, where the herds cannot pause in fall because of the need to cross the range. This explains the insufficient use of bog vegetation in local deer breeding, which is characteristic of the fall pasture regime.

VI. Mating-season pastures

The mating season makes a number of specific demands of the pasture where it occurs: the pasture must be well tended, situated close to wintering places and far from large predators. Abundant quantities of reindeer moss and other feeds must be concentrated in a restricted area and facilitate heavy feeding for the females and general fattening of the herd before it moves to winter pasture.

The mating-season pastures are in narrow woodless valleys of the forest zone near the main line of the range, most often on the Aldan slope. They usually include the following associations:

1. Small-sedge and small-cereal meadows with Poa pratensis, Festuca supina Schur, the sedges Carex bigelowii and C. capitate (reserves of feeds other than reindeer moss: 1400—1500 kg/ha.

2-4. Grasslands with Bromus sibiricus, Avenastrum dahuricum, Poa pratensis; the reserves reach 1700 (2300) kg/ha.

5. Stands with Cobresia bellardii (All.) Degl. (1500 kg/ha).

6. Cereal and dwarf birch stands (reserves of feeds other than reindeer moss are about 1200 kg/ha, those of reindeer moss, 100—150 kg/ha).

7. Lichen and dwarf birch stands (reserves of feeds other than reindeer moss are about 200 kg/ha, of reindeer moss 600—700 kg/ha).

8. Willow stands dominated by various shrubby willows.

9. Lichen woodlands and wastes with the larch Larix gmelini (feeds other than reindeer moss — almost exclusively dwarf birch—up to 500—600 kg/ha, of reindeer moss—200 kg/ha).

The reindeer moss on local mating-season pastures is almost entirely destroyed (80—90%), hence its small amount. This is the principal defect of these pastures; good mating-season pastures are rare here but less so than calving and summer pastures.

VII. Winter pastures

The rather less severe climate of the range district, its sheltered valleys, and the rich reindeer moss cover of the adjacent slopes make this region more suitable for wintering than high plateaus.

Below are six basic associations used for winter grazing.

1. Low shrub—reindeer moss—stone pine groves with Pinus pumila (Pall.) Rgl. on southern slopes. This is apparently the only form of wintering in the zone beneath the barren summits (other forms are found

in the zone of woody vegetation). Feeds other than reindeer moss consist almost exclusively of Betula middendorffi (100—150 kg/ha). The lichen reserves amount here to about 2000 kg/ha (grazing 25%).

2. Sparse larch woodlands and wastes with Cladonia alpestris near the upper limits of woody vegetation. A thick carpet of reindeer moss covers the soil almost completely (7000 kg/ha of live bulk in air-dry condition). There is little other feed (Salix pulchra 14 kg/ha, S. phylicifolia —14, Arctagrostis arundinacea — 116, total— about 150 kg/ha).

3. Larch woodlands with Cetraria cucullata and Cladonia gracilis (L.) Willd. Situated beneath the former. There is more green material, the reserves of lichens are not so great (5000 kg/ha) and they are of inferior quality.

4. Moist reindeer moss and sphagnum—reindeer moss—larch wastes on steep northern slopes. The quantities of Cladonia alpestris reach 9500 kg/ha, but there is practically no green feed (Carex rigidioides Gorodk. —sp., Calamagrostis lapponica — sp.—cop.$_1$).

5. Poplar—Chosenia arbutifolia groves. The deer use the dry leaves from beneath the snow.

6. Marshy larch woodlands with Eriophorum vaginatum (1800 kg/ha). Here, the deer also find Claytonia acutifolia, horse-tails, etc.

The general drawbacks of wintering places are: insufficient reserves of feeds other than reindeer moss; some of the valleys are canyon-shaped, their slopes precipitous and inaccessible and dangerous for deer and men. This is especially so at the end of winter, when the snow is deep and packed, and the deer begin to suffer from starvation; the lack of reserves of the epiphytic lichens Alectoria, Usnea and Evernia makes things even more difficult. We have not yet sufficient data for a well-founded sub-division of winter into smaller pasture seasons.

In general, the pastures are divided according to natural regions; the wintering places are situated in the narrow-valley region, the summer pastures in the wide-valley region and in the region of the highest elevations, and the pastures of intermediate seasons are at the borders between the above regions.

The diet of deer in this area must contain equal quantities of reindeer moss and of feeds other than reindeer moss throughout the year. Many flaws in distribution of local pastures are due to the fact that these specific conditions of feeding are insufficiently taken into account, compared with other regions. On their calving, spring and summer pastures the deer suffer from lack of reindeer moss; on wintering places they suffer from lack of other feeds.

Estimates of the pastures for deer breeding are very discrepant. The land and water management plan for 1936 in the Tompo District stated that the then existing stock of deer—12,500 head (including 10,896 collectivized)—had ample pasturage. According to our data, the livestock in 1954 were reduced to 8668 head and suffered from lack of pasture grounds and feed. In part, this is due to deterioration of the pastures in the past. But the main cause of the discrepancies is that estimates of the territory's deer-carrying capacity were formerly based upon abstract data and the local experienced deer breeders' knowledge was not used.

The deer herds in the Tompo District are now adequately provided with winter, spring, early-summer and early-fall pastures, but calving and summer pastures are badly needed; mating-season pastures are lacking. Calving pastures suffer from uncontrolled burning designed to improve cotton grass growth; due to this, appreciable stretches of Cladonia alpestris, which is needed during calving no less than cotton grass, are destroyed. Many of the calving pastures are situated on the opposite side of the range, at great distances from wintering places. This interferes greatly with their use.

Fires, caused by negligence of expedition workers, hunters and often the deer breeders themselves, are becoming the bane of deer raising; the wintering places suffer and have to be abandoned for many years (Kakavu and others).

The most serious obstacle to the development of reindeer keeping is the absence of pasture rotation. If a team has once erred in establishing a route for three years in advance, it repeats the error every three years; as a result, the herd follows the same route for many years, and a number of pastures are grazed to the limit (Sulid'un — summer pastures; Sanar — mating pastures, Sogyn'kan and Nelerbe — calving pastures, etc.), but other pastures which are off the fixed route remain untouched.

There are other causes why many pastures are not exploited.

1. Free grazing. The herdsman does not always follow the herd. He sends it in a definite direction and checks its presence every 1 — 2 days. The unattended herd bypasses many plots which should have been visited.

2. Large herds cannot utilize small pastures even though they may contain considerable reserves of feeds.

The above causes are partly due to lack of manpower which would be made available after fencing is completed.

I consider the following improvements in deer pasture utilization in the surveyed part of the Verkhoyansk area to be appropriate.

The sequence of pasture distribution now used by many groups of herdsmen should be generally adopted: wintering in the narrow-valleyed region; calving at the southern border of the wide-valleyed region; summering in the wide-valleyed region, and mating in the northern part of the narrow-valleyed region. Firstly, this provides the reindeer with the feeds needed in different seasons; secondly, it avoids long treks and the movement of the herd becomes more uniform.

For each herd, the pasture areas must be arranged for more uniform consumption of reindeer moss and of other feeds. In the course of all seasons, spring, summer and fall pastures must contain 50, 25 and 50% of reindeer moss in the total reserve. Determination of carrying capacity and allotment of pasture areas can only be performed with the assistance of an experienced deer breeder who is well acquainted with the given district (N. I. Temnoev, 1961).

There must be no fixed route for a given herd for many years. Only a change to annual alternation of routes according to pasture rotation can produce an improvement in deer-breeding lands. In the Verkhoyansk area, the rate of growth of reindeer moss is 3.25 mm annually, which requires a pasture-rotation period of at least 4 — 5 years (Kuvaev and Samarin, 1961), i.e., each herd requires 4 — 5 routes, at least for the critical seasons.

This is possible only if we begin to utilize the unexploited reserve areas. They suit every season—winter (Imtand'a, Solotur, Nekuchen, Betyuchen), calving (D'agdegend'a, Tankylak), summer (Sulanechen-Mola, upper reaches of Nelgese), mating (Kene-Tukulan, Tuora-Tukulan, Mevki); the list can be extended for each season.

The problem of rehabilitating winter pastures must be solved. First of all, we must experiment with additional planting of fodder plants other than reindeer moss Chosenia arbutifolia, the willow Salix speciosa, Oxytropis adamsiana, Chamaenerium latifolium (L.) Scop. and others. At the end of the winter additional hay could be fed: natural meadows and meadows which arise on the sites of corrals are rather widely distributed in this region and have been previously described together with the possibilities of using drying machines (White and Yeo, 1954; Kuvaev, 1960; Kuvaev and Samarin, 1961). Meadows and hay reserves bordering the pathways between wintering places and calving pastures should be especially valuable.

The principal method of improving and extending the calving pastures is the spring burning of old grass in cotton grass fields, provided the fire is strictly controlled and kept from reindeer moss areas.

For summer, early-fall and other pastures the fencing now practiced by foremost teams (Sanar, Uchasyn, Evrind'e) is of special value. There are suitable areas in wide-valleyed as well as in narrow-valleyed regions (D'orand'a, Mevki, Ken-Yureekh, Kende, Tenkuchen, Nelgese, at the mouths of Mamyn and Atykan-Mon rivers). Fencing could free man-power for temporary division of large deer herds into small herds and make possible the use of small-sized pastures, correct equipping of wintering places, mating-period pastures, etc. Especially important is the detection of new "chistais."

On mating-season pastures, hedges are desirable in addition to corrals. New mating-season pastures, as well as calving pastures, can be found in the northwest part of the narrow-valleyed region.

The methods of grazing large herds must be altered. In reindeer raising as practiced by Nenets, Zyryans, and other deer breeders in western regions, the herdsman must always accompany his herd to ensure more uniform grazing of large areas and utilization of a part of the small-sized pastures even by large herds.

At present, the entire reindeer raising of the Tompo District is concentrated in a single huge "kolkhoz", which greatly interferes with the management by deer-breeding teams before the land-management planning has been carried out. Such huge kolkhozes must be divided into smaller units. The land management of the kolkhozes proper, as well as that of land between the kolkhozes, must be based on detailed knowledge of the region and of the local reindeer breed.

Deer raising in the surveyed part of the Verkhoyansk area has some difficulties, but it has very good prospects (demand for transport and reindeer products). When all the lands have been found and correctly utilized, the number of head and the level of reindeer management in the given region may be considerably raised.

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* [NKZ—Narodnyi Komissariat Zemledeliya. People's Commissariat for Agriculture.]

** [MSKh—Ministerstvo Sel'skogo Khozyaistva. Ministry of Agriculture.]

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